

- 56B 68
f 13
- 1 90. (Amended) A method of processing packets in a router, comprising:
2 receiving a packet from a network;
3 determining the type of service required by a received packet; and,
4 distributing, in response to said type of service, said received packet to a selected
5 processing engine located within said router, said selected processing engine providing
6 said type of service.

REMARKS

This Amendment is filed in response to the Office Action mailed on June 19, 2002. All objections and rejections are respectfully traversed.

Claims 1-3, 9, 11, 12, 15-18, 20, 21, 23, 26, 27, 29-32 and 44-96 are pending in the case.

Various claims were amended to better claim the invention.

At paragraph 4 of the **OFFICE ACTION SUMMARY** a comma is placed between claim number 1 and claim number 3, indicating that claim 2 is not in the case. Applicant respectfully urges that claim 2 is pending in the case. In support of this position Applicant points to the following history:

1. The Office Action mailed by the USPTO on 08/01/01 has a dash between claim No. 1 and claim No. 3, indicating that claim 2 is pending. This position is consistent with all earlier papers in the case.

2. The Amendment filed on September 11, 2001, in response to the 08/01/01 Office Action, amended claim 2.

3. The Office Action mailed by the USPTO on 12/04/2001 in response to the September 11, 2002, Amendment, has a comma between claim No. 1 and Claim No. 3, indicating that Claim 2 is not pending.

4. Again in the Office Action mailed by the USPTO on 06/19/2002 a comma separates claim No. 1 and claim No. 3, indicating that claim 2 is not in the case.

Applicant respectfully urges that the omission of Claim 2 from the list of pending claims in the September 11, 2002 Office Action, and subsequent Office Actions, was a typographical error.

Accordingly, Applicant respectfully requests that Claim 2 be considered as pending in the case.

At paragraph 1 of the Office Action the drawings were objected to on the grounds that the queues recited in claim 55 are not shown in the drawings. Applicant respectfully traverses this objection.

Applicant respectfully points out that a queue is a data structure held by a processor, and the holding of data packets in a processor, RPE 50 of Fig. 1, is fully disclosed in the specification at page 16 lines 5-10 as follows:

“An RPE 50 receives a packet digest with a packet digest header containing classification information provided by the DC 30. Based on classification information, the packet is put into one of a small number of input queues on the RPE 50. The intent if the RPE 50 queuing is to provide the

capability for handling both high- and low- priority packets. Packets are processed from among the RPE's input queues by the RPE 50 processor in whatever order it sees fit."

Applicant respectfully urges that the illustration of RPE 50 in Fig. 1, coupled with the description of RPE 50 holding a "small number of input queues" adequately support, in the drawings, Applicant's recitation of "a plurality of queues" in Claim 55.

At paragraphs 2-5 of the Office Action Claims 15, 16, 23, 44, and 73 were rejected under 35 U.S.C. 112, first paragraph, on the grounds that claimed subject matter was not sufficiently described in the specification.

Regarding claims 15 and 16, the Examiner states that the feature "the port adapter converts input data to a desired interface" is not disclosed. Applicant respectfully urges that the specification at page 9 lines 14-19 fully disclose the quoted feature as:

"Various types of PAs are available to convert between different user interfaces and a generic PCI bus. The PCI (Peripheral Component Interconnect) bus is known in both the computer and networking industries. FIG. 3a shows a representative PA design for an Ethernet interface. FIG. 3b shows a representative PA design for a channelized T3 line (CT3) interface. Other user interfaces such as OC-3 (a fiber-optic standard) may also be converted using a PA."

The quoted paragraph of the specification both explicitly states that the port adapters (PAs) convert data for a desired interface, and gives examples of interfaces for which the conversion is made. Again, Applicant respectfully urges that the specification at page 9 lines 14-19 fully disclose the claimed feature.

Regarding claim 23, the Examiner states that: "The specification does not adequately describe the feature of 'distributing, in response to the hash function, the packet evenly among the plurality of processing engines'. More specifically, the specification

does not describe any step or process (such as involving counting of data packets at each processing engine) the even distribution.”

Applicant respectfully points out that the specification states, at page 7 lines 5-13

“The present invention provides a router architecture capable of implementing a wide variety of services while balancing the router system load among a number of processors. The router architecture of the present invention is also capable of distributing the load from a single uplink among the multiple processors. The ability to distribute the router system load among all of the processors in the system makes the system throughput scalable; the throughput rate increases with each additional processor. Because there is no cooperation problem among the processors and each is acting independently and preferably on separate flows, the system throughput is expected to scale approximately linearly with the number of processors.”

and at page 17 line 20 - page 18 line 2:

“Other alternative embodiments include performing some services of a bounded nature on the DCs, as is currently done with output queuing. For example, the DCs could accumulate statistics and do flow-based accounting on each packet. In this way, the DCs could handle some portion of the known processing load leaving unbounded and future services to the RPEs.”

Applicant respectfully points out that the recited “distributing, in response to the hash function, the packet evenly among the plurality of processing engines” is done by sending different flows to different processors, and so the “even” distribution is inherent in Applicant’s use of a hash function to distribute flows. And if accounting is desired, the disclosure on page 17 adequately points out that the DCs can be used for packet accounting, if desired.

Regarding claim 23, the Examiner states that “a hashing function that causes the packets to be mostly evenly distributed among the processing engines” is not adequately described.

Applicant respectfully points out that this objection is similar to the objection concerning claim 23, and that the above argument shows that the feature of “a hashing function that causes the packets to be mostly evenly distributed among the processing engines” is accomplished by the hash function sending packets of different flows to different processing engines. There is no need to actually count the packets in order to accomplish the claimed even distribution, and if counting is required it is fully disclosed at page 17 line 20 - page 18 line 2.

Regarding claim 44 and claim 73, the approximately even distribution of the packets among the processors is done by the hash function sending packets from different flows to different route processing engines, as the disclosure in the specification set out hereinabove indicates.

At paragraph 6 of the Office Action numerous claims were rejected under 35 U.S.C. 102 as being anticipated by Imai et al. U. S. Patent No. 6,175,874 issued January 16, 2001.

The invention, as set out in representative independent claim 1, comprises in part:

1. A router for distributing packets in a network, wherein the packets originate at a source and are routed to a destination, comprising:

a plurality of route processing engines located within said router;

a mechanism that performs a hashing function on at least a portion of network layer information in the packets transferred to the routing system, to produce an indicia of a flow and,

means for switching packets with a same said indicia of a flow to *a single route processing engine of said plurality of route processing engines.*

The Imai patent discloses a computer network having a plurality of processing nodes, and having a relay device, where the relay device has a network address corresponding to a node which processes requests, referred to as a virtual node. The relay device distributes requests which it receives from the computer network to a plurality of processing nodes, and each of the processing nodes performs a response to the request addressed to the virtual node. The relay device computes a hash function based on data in a received request packet to generate a hash output, and uses the hash output to select a processing node, selected from the plurality of processing nodes, to process the request.

Applicant respectfully points out that the claimed route processing engines are located in a router as:

a plurality of route processing engines located within said router . . .
. . . means for switching packets with a same said indicia of a flow to a
single route processing engine of said plurality of route processing engines

In sharp contrast, Imai has his processing distributed in a computer network as separate processing nodes, and where the packets are distributed by another network device referred to by Imai as a relay device. In Imai, packets are addressed to his relay device. Imai has no disclosure of Applicant's claimed having the processing engines located in a router. Accordingly, Applicant respectfully urges that the Imai disclosure does not teach Applicant's claimed invention.

Further, Applicant's claimed router is a single box device which performs routing on packets addressed to a destination node elsewhere in the computer network. The architecture of Applicant's single box device is shown in Fig. 1, and is described in the specification with reference to Fig. 1.

Accordingly, Applicant respectfully urges that the complex network cluster described by Imai cannot anticipate Applicant's claimed single box device under 35 U.S.C. 102.

At paragraph 7-8 of the Office Action various claims were rejected under 35 U.S.C. 103(a) as being unpatentable over Imai.

Again, Applicant respectfully points out that Imai does not disclose Applicant's claimed route processing engines located in a router as:

*a plurality of route processing engines located within said router . . .
... means for switching packets with a same said indicia of a flow to a
single route processing engine of said plurality of route processing engines.*

Applicant respectfully urges that the Imai patent is legally precluded from rendering Applicant's claimed invention obvious under 35 U.S.C. 103 because of the absence in Imai of Applicant's claimed route processing engines located in a router as: *a plurality of route processing engines located within said router means for switching packets with a same said indicia of a flow to a single route processing engine of said plurality of route processing engines.*

At paragraph 9 at page 12 of the Office Action claims 3 and 12 were rejected under 35 U.S.C. 103(a) as being unpatentable over Imai in view of Varghese et al. U. S. Patent No.

5,905,723 issued May 18, 1999. Applicant respectfully points out that both claim 3 and claim 12 are dependent. Applicant respectfully urges that all independent claims are allowable, in view of Applicant's argument regarding representative Claim 1.

At paragraph 9 on page 13 of the Office Action claims 52, 53, 61-66, 78, and 80-84 were indicated to be allowable if written in independent form. Accordingly, the independent claims of this group were written in independent form.

At paragraph 10 on page 13 of the Office Action arguments were presented traversing Applicant's arguments made in an earlier Amendment. The Office Action states:

“Applicant argument is thus traversed with regard to the “processing engines inside the router” which is not a claimed subject matter.”

Applicant respectfully urges that the amendments to the independent claims presented herein more particularly point out that the “processing engines” are inside the “router”. Accordingly, Applicant respectfully urges that the independent claims are all patentable over the disclosures of Imai of a computer network with a relay device to which packets are addressed, and from which packets are distributed to separate computers.

All independent claims are believed to be in condition for allowance.

All dependent claims are believed to be dependent from allowable independent claims, and therefore in condition for allowance.

Favorable action is respectfully solicited.

Please charge any additional fee occasioned by this paper to our Deposit Account No.
03-1237.

Respectfully submitted,

A handwritten signature in cursive script, reading "A. Sidney Johnston". The signature is written in dark ink and is positioned above the printed name and address.

A. Sidney Johnston
Reg. No. 29,548
CESARI AND MCKENNA, LLP
88 Black Falcon Avenue
Boston, MA 02210-2414
(617) 951-2500

**MARK-UP PAGES FOR THE SEPTEMBER 19, 2002, AMENDMENT TO
U.S. PATENT APPLICATION SER. NO. 09/053,237**

The replacement for the FIRST full paragraph of page PAGE resulted from the following changes:

COPY PARAGRAPH TO BE AMENDED HERE.

The replacement for claim CLAIM resulted from the following changes:

COPY CLAIM TO BE AMENDED HERE.

- 1 1. (Five Times Amended) A router [routing system] for distributing packets in a
2 network, wherein the packets originate at a source and are routed to a destination, com-
3 prising:
4 a plurality of route processing engines located within said router;
5 a mechanism that performs a hashing function on at least a portion of network
6 layer information in the packets transferred to the routing system, to produce an indicia of
7 a flow and,
8 means for switching packets with a same said indicia of a flow to a single route
9 processing engine of said plurality of route processing engines.

- 1 11. (Four Times Amended) A router for distributing packets in a network,
2 wherein the packets originate at a source and are routed to a destination, comprising:
3 a plurality of network interfaces that transfer the packets to a destination and from
4 a source;
5 a plurality of route processing engines located within said router;
6 a fabric interconnecting said plurality of network interfaces and said plurality of
7 route processing engines;

8 a hashing function to determine a distribution of the packets, by said fabric in re-
9 sponse to an output of said hashing function, among said plurality of route processing
10 engines.

1 17. (Twice Amended) A method, in a router, for selecting one processing engine
2 of a plurality of processing engines located within the router for processing at least one
3 packet, the method comprising the steps of:
4 hashing at least a portion of network layer information of at least one packet to
5 determine a hash result, said hash result indicating a flow;
6 selecting one processing engine of said plurality of processing engines located
7 within said router to process the flow indicated by said hash result.

1 26. (Twice Amended) A system, in a router, for selecting one processing engine
2 of a plurality of processing engines located within said router for processing at least one
3 packet, the system comprising:
4 means for examining at least a portion of network layer flow information of the at
5 least one packet; and
6 means, responsive to said at least a portion of network layer flow information, for
7 selecting the one processing engine of said plurality of processing engines located within
8 said router to preserve a packet flow indicated by the at least a portion of network layer
9 flow information.

1 45. (Amended) A router, comprising:
2 a plurality of processing engines located within said router for processing packets;
3 an interface for receiving a received packet from a network;
4 a data compiler to perform a hash function on said received packet to generate a hash
5 result, and to select a selected processing engine from said plurality of processing engines
6 located within said router in response to said hash result; and,
7 a switch to distribute said packet to said selected processing engine.

1 52. (Amended) [The router as in claim 45 further comprising:] A router, comprising:
2 a plurality of processing engines for processing packets;
3 an interface for receiving a received packet from a network;
4 a data compiler to perform a hash function on said received packet to generate a hash
5 result, and to select a selected processing engine from said plurality of processing engines in
6 response to said hash result; and,
7 a switch to distribute said packet to said selected processing engine; and
8 said data compiler determines an IP source address having source bytes and an IP
9 destination address having destination bytes and a protocol byte, and performs said hash
10 function by performing an exclusive OR (XOR) to said source bytes and said destination
11 bytes and said protocol byte to generate said hash result as at least one output byte, said at
12 least one output byte to designate a flow to which said received packet belongs, and routing
13 all packets having the same flow to a selected processing engine.

1 53. (Amended) [The router as in claim 45 further comprising:] A router, comprising:
2 a plurality of processing engines for processing packets;
3 an interface for receiving a received packet from a network;

4 a data compiler to perform a hash function on said received packet to generate a hash
5 result, and to select a selected processing engine from said plurality of processing engines in
6 response to said hash result;
7 a switch to distribute said packet to said selected processing engine; and
8 said data compiler puts packets received from said network into packet digest form
9 before transferring them to said switch.

1 55. (Amended) The router as in claim 45, further comprising:
2 each processing engine of said plurality of processing engines [engine] has a plurality of
3 queues, said packet has classification information in a header, and said processing engine
4 selects a queue of said plurality of queues in response to said classification information.

1 61. (Amended) [The router as in claim 45, further comprising:] A router, comprising:
2 a plurality of processing engines for processing packets;
3 an interface for receiving a received packet from a network;
4 a data compiler to perform a hash function on said received packet to generate a hash
5 result, and to select a selected processing engine from said plurality of processing engines in
6 response to said hash result;
7 a switch to distribute said packet to said selected processing engine; and
8 said data compiler detecting that a particular packet requires specialized processing;
9 and
10 said switch distributing said particular packet to a specialized processing engine to
11 perform said specialized processing.

1 70. (Amended) A router, comprising:
2 a plurality of processing engines located within said router for processing packets;
3 an interface for receiving a received packet from a network;
4 means for performing a hash function calculation on said received packet to produce
5 a hash result; and,
6 means, responsive to said hash result, for switching said received packet to a proc-
7 essing engine selected from said plurality of processing engines located within said router for
8 further processing of said received packet.

1 78. (Amended) [The method as in claim 71 further comprising:] A method of processing
2 packets in a router, comprising:
3 receiving a packet from a network;
4 performing a hash function calculation on said packet to produce a hash result;
5 switching, in response to said hash result, said packet to a processing engine of a plu-
6 rality of processing engines in said router, for further processing of said packet; and
7 performing an exclusive OR (XOR) in response to a source address and a destination
8 address and a protocol byte to generate said hash result as at least one output byte, said at
9 least one output byte to designate a flow to which said received packet belongs, and routing
10 all packets having the same flow to a selected processing engine.

1 80. (Amended) [The method as in claim 71 further comprising:] A method of processing
2 packets in a router, comprising:
3 receiving a packet from a network;
4 performing a hash function calculation on said packet to produce a hash result;

5 switching, in response to said hash result, said packet to a processing engine of a plu-
6 rality of processing engines in said router, for further processing of said packet;
7 detecting that a particular packet requires specialized processing; and
8 distributing said particular packet to a specialized processing engine to perform said
9 specialized processing.

1 85. (Amended) A router, comprising:
2 a plurality of processing engines located within said router for processing packets;
3 an interface for receiving a received packet from a network;
4 a data compiler to determine a type of service required by a received packet; and,
5 a switch, responsive to said type of service, to distribute said packet to a selected
6 processing engine of said plurality of processing engines located within said router, said se-
7 lected processing engine providing said type of service.

1 90. (Amended) A method of processing packets in a router, comprising:
2 receiving a packet from a network;
3 determining the type of service required by a received packet; and,
4 distributing, in response to said type of service, said received packet to a selected
5 processing engine located within said router, said selected processing engine providing said
6 type of service.

CLAIMS CURRENTLY PENDING

- 1
- 2 1. A router for distributing packets in a network, wherein the packets originate at a
3 source and are routed to a destination, comprising:
- 4 a plurality of route processing engines located within said router;
5 a mechanism that performs a hashing function on at least a portion of network
6 layer information in the packets transferred to the routing system, to produce an indicia of
7 a flow and,
8 means for switching packets with a same said indicia of a flow to a single route
9 processing engine of said plurality of route processing engines.
- 1 2. The routing system of claim 1, further comprising:
2 at least one fast uplink connection to an external network to accept outgoing
3 packets from a plurality of processing engines.
- 1 3. The routing system of claim 1, further comprising:
2 a crossbar as said means for switching packets.
- 1 9. The routing system of claim 1, further comprising:
2 means for scaling processing power of said system by adding additional route
3 processing engines to said plurality of route processing engines.

1 11. A router for distributing packets in a network, wherein the packets originate at a
2 source and are routed to a destination, comprising:
3 a plurality of network interfaces that transfer the packets to a destination and from
4 a source;
5 a plurality of route processing engines located within said router;
6 a fabric interconnecting said plurality of network interfaces and said plurality of
7 route processing engines;
8 a hashing function to determine a distribution of the packets, by said fabric in re-
9 sponse to an output of said hashing function, among said plurality of route processing
10 engines.

1 12. The routing system of claim 11, further comprising:
2 said fabric includes a crossbar.

1 15. The routing system of claim 11, further comprising:
2 a port adapter, wherein the port adapter converts input data to a desired interface.

1 16. The routing system of claim 15, wherein said network interfaces include at least
2 one uplink connection to an external network, wherein the port adapter converts input
3 data to a known interface.

1 17. A method, in a router, for selecting one processing engine of a plurality of proc-
2 essing engines located within the router for processing at least one packet, the method
3 comprising the steps of:

4 hashing at least a portion of network layer information of at least one packet to
5 determine a hash result, said hash result indicating a flow;

6 selecting one processing engine of said plurality of processing engines located
7 within said router to process the flow indicated by said hash result.

1 18. The method of claim 17, further comprising:

2 the network layer information comprises one or more of the following network in-
3 formation: a network source address of the at least one packet, a network destination
4 address of the at least one packet, a network destination address of the at least one
5 packet, a source port of the at least one packet, and a protocol type value of the at least
6 one packet.

1 20. The method of claim 17, further comprising:

2 the hashing is computed by logically XORing an addresses, a port, and a protocol
3 type value.

1 21. The method of claim 17, further comprising:

2 providing a table containing entries for use in selecting the one processing engine;

3 selecting one entry in the table specified by an index value, the index value based
4 upon the hash value to select the processing engine for the hash value.

1 23. The method of claim 17, further comprising:

2 distributing, in response to the hash function, the packets evenly among the plu-
3 rality of processing engines.

1 26. A system, in a router, for selecting one processing engine of a plurality of proc-
2 essing engines located within said router for processing at least one packet, the system
3 comprising:

4 means for examining at least a portion of network layer flow information of the at
5 least one packet; and

6 means, responsive to said at least a portion of network layer flow information, for
7 selecting the one processing engine of said plurality of processing engines located within
8 said router to preserve a packet flow indicated by the at least a portion of network layer
9 flow information.

1 27. The system of claim 26 wherein the network layer flow information comprises:
2 at least one of a network source address of the at least one packet, a network des-
3 tination address of the at least one packet, a source port of the at least one packet, a desti-
4 nation address of the at least one packet, and a protocol type value of the at least one
5 packet.

1 29. The system of claim 26, further comprising:
2 the hash value is computed by logically XORing the addresses, the ports, and the
3 protocol type value.

1 30. The system of claim 26 further comprising:

2 means for providing a table containing entries for use in selecting the one proc-
3 essing engine; and
4 means, responsive to the hash value, for selecting one entry in the table.

1 31. The system of claim 26, further comprising:
2 the means for selecting carries out a hashing function that preserves the packet
3 flow.

1 32. The system of claim 26, further comprising:
2 the at least one packet is one of a plurality of packets, and the means for selecting
3 carries out a hashing function that causes the packets to be mostly evenly distributed
4 among the processing engines.

1 44. A routing system for distributing packets in a network, wherein the packets origi-
2 nate at a source and are routed to a destination, both source and destination external with
3 respect to the routing system, comprising:
4 a plurality of network interfaces that transfer packets to said destination and from
5 said source;
6 a plurality of route processing engines;
7 a hash mechanism that performs a hashing function on at least a portion of net-
8 work layer information of a particular packet, in the packets transferred to the routing
9 system, to determine an approximately even distribution of the packets to the route proc-
10 essing engines for processing by the engines, and said hash mechanism producing a hash
11 result giving an indication of a flow of said particular packet so that packets of a flow are
12 switched to the same route processing engine of said plurality of route processing en-
13 gines.

1 45. A router, comprising:
2 a plurality of processing engines located within said router for processing packets;
3 an interface for receiving a received packet from a network;
4 a data compiler to perform a hash function on said received packet to generate a
5 hash result, and to select a selected processing engine from said plurality of processing
6 engines located within said router in response to said hash result; and,
7 a switch to distribute said packet to said selected processing engine.

1 46. The router as in claim 45 further comprising:
2 said data compiler selection of said processing engine is partly table driven.

1 47. The router as in claim 45 further comprising:
2 said data compiler distributes the packets evenly among said plurality of process-
3 ing engines.

1 48. The router as in claim 45 further comprising:
2 said hash function uses a source address information.

1 49. The router as in claim 45 further comprising:
2 said hash function uses a destination address information.

1 50. The router as in claim 45 further comprising:

2 said hash function uses a protocol information.

1 51. The router as in claim 45 further comprising:

2 said hash function uses a source port information.

1 52. A router, comprising:

2 a plurality of processing engines for processing packets;

3 an interface for receiving a received packet from a network;

4 a data compiler to perform a hash function on said received packet to generate a
5 hash result, and to select a selected processing engine from said plurality of processing
6 engines in response to said hash result; and,

7 a switch to distribute said packet to said selected processing engine; and

8 said data compiler determines an IP source address having source bytes and an IP
9 destination address having destination bytes and a protocol byte, and performs said hash
10 function by performing an exclusive OR (XOR) to said source bytes and said destination
11 bytes and said protocol byte to generate said hash result as at least one output byte, said at
12 least one output byte to designate a flow to which said received packet belongs, and
13 routing all packets having the same flow to a selected processing engine.

1 53. A router, comprising:

2 a plurality of processing engines for processing packets;

3 an interface for receiving a received packet from a network;

4 a data compiler to perform a hash function on said received packet to generate a
5 hash result, and to select a selected processing engine from said plurality of processing
6 engines in response to said hash result; and,
7 a switch to distribute said packet to said selected processing engine; and
8 said data compiler puts packets received from said network into packet digest
9 form before transferring them to said switch.

1 54. The router as in claim 45, further comprising:

2 said switch receiving said received packet from said processing engine after said
3 processing engine finishes processing said packet as a processed packet, and then said
4 switch routing said processed packet to an interface to transmit said processed packet out
5 to said network.

1 55. The router as in claim 45, further comprising:

2 each processing engine of said plurality of processing engines has a plurality of
3 queues, said packet has classification information in a header, and said processing engine
4 selects a queue of said plurality of queues in response to said classification information.

1 56. The router as in claim 55, further comprising:

2 said classification information indicates a priority of said packet.

1 57. The router as in claim 45, further comprising:

2 said processing engine performs routing of said packet.

1 58. The router as in claim 45, further comprising:

2 said processing engine performs tag application update on said packet.

1 59. The router as in claim 45, further comprising:

2 said processing engine performs filtering on said packet.

1 60. The router as in claim 45, further comprising:

2 said data compiler allocating said processing of packets to remaining processing
3 engines in the event that a processor fails.

1 61. A router, comprising:

2 a plurality of processing engines for processing packets;

3 an interface for receiving a received packet from a network;

4 a data compiler to perform a hash function on said received packet to generate a
5 hash result, and to select a selected processing engine from said plurality of processing
6 engines in response to said hash result; and,

7 a switch to distribute said packet to said selected processing engine; and

8 said data compiler detecting that a particular packet requires specialized process-
9 ing; and

10 said switch distributing said particular packet to a specialized processing engine
11 to perform said specialized processing.

1 62. The router as in claim 61, further comprising:

2 said specialized processing is compression.

1 63. The router as in claim 61, further comprising:
2 said specialized processing is decompression.

1 64. The router as in claim 61, further comprising:
2 said specialized processing is encryption.

1 65. The router as in claim 61, further comprising:
2 said specialized processing is routing.

1 66. The router as in claim 45, further comprising:
2 said processing engine designates a high bandwidth uplink to receive said packet.

1 67. The router as in claim 45, further comprising:
2 said processing engine performs encryption on said packet.

1 68. The router as in claim 45, further comprising:
2 said processing engine performs decryption on said packet.

1 69. The router as in claim 45, further comprising:
2 said switch is a crossbar switch.

1 70. A router, comprising:
2 a plurality of processing engines located within said router for processing packets;
3 an interface for receiving a received packet from a network;
4 means for performing a hash function calculation on said received packet to pro-
5 duce a hash result; and,
6 means, responsive to said hash result, for switching said received packet to a
7 processing engine selected from said plurality of processing engines located within said
8 router for further processing of said received packet.

1 71. A method of processing packets in a router, comprising:
2 receiving a packet from a network;
3 performing a hash function calculation on said packet to produce a hash result;
4 and,
5 switching, in response to said hash result, said packet to a processing engine of a
6 plurality of processing engines in said router, for further processing of said packet.

1 72. The method as in claim 71, further comprising:
2 selecting a processing engine by using said hash result and a table.

1 73. The method as in claim 71, further comprising:
2 distributing the packets evenly among said plurality of processing engines.

1 74. The method as in claim 71 further comprising:
2 using a source address information in said hash function calculation.

1 75. The method as in claim 71 further comprising:
2 using a destination address information in said hash function calculation.

1 76. The method as in claim 71 further comprising:
2 using a protocol information in said hash function calculation.

1 77. The method as in claim 71 further comprising:
2 using a source port information in said hash function calculation.

1 78. A method of processing packets in a router, comprising:
2 receiving a packet from a network;
3 performing a hash function calculation on said packet to produce a hash result;
4 and,
5 switching, in response to said hash result, said packet to a processing engine of a
6 plurality of processing engines in said router, for further processing of said packet; and
7 performing an exclusive OR (XOR) in response to a source address and a desti-
8 nation address and a protocol byte to generate said hash result as at least one output byte,
9 said at least one output byte to designate a flow to which said received packet belongs,
10 and routing all packets having the same flow to a selected processing engine.

1 79. The method as in claim 71 further comprising:
2 allocating said packets to remaining processing engines in the event that a proc-
3 essing engine fails.

1 80. A method of processing packets in a router, comprising:

2 receiving a packet from a network;
3 performing a hash function calculation on said packet to produce a hash result;
4 and,
5 switching, in response to said hash result, said packet to a processing engine of a
6 plurality of processing engines in said router, for further processing of said packet;
7 detecting that a particular packet requires specialized processing; and
8 distributing said particular packet to a specialized processing engine to perform
9 said specialized processing.

1 81. The method as in claim 80 further comprising:
2 processing compression as said specialized processing.

1 82. The router as in claim 80, further comprising:
2 processing decompression as said specialized processing.

1 83. The router as in claim 80, further comprising:
2 processing encryption as said specialized processing.

1 84. The router as in claim 80, further comprising:
2 processing routing as said specialized processing.

1 85. A router, comprising:
2 a plurality of processing engines located within said router for processing packets;
3 an interface for receiving a received packet from a network;
4 a data compiler to determine a type of service required by a received packet; and,

5 a switch, responsive to said type of service, to distribute said packet to a selected
6 processing engine of said plurality of processing engines located within said router, said
7 selected processing engine providing said type of service.

1 86. The apparatus as in claim 85 further comprising:
2 said type of service is compression.

1 87. The apparatus as in claim 85, further comprising:
2 said type of service is decompression.

1 88. The router as in claim 85, further comprising:
2 said type of service is encryption.

1 89. The router as in claim 85, further comprising:
2 said type of service is routing.

1 90. A method of processing packets in a router, comprising:
2 receiving a packet from a network;
3 determining the type of service required by a received packet; and,
4 distributing, in response to said type of service, said received packet to a selected
5 processing engine located within said router, said selected processing engine providing
6 said type of service.

1 91. The method as in claim 90 further comprising:
2 processing compression as said type of service.

1 92. The router as in claim 90, further comprising:
2 processing decompression as said type of service.

1 93. The router as in claim 90, further comprising:
2 processing encryption as said type of service.

1 94. The router as in claim 90, further comprising:
2 processing routing as said type of service.

1 95. A computer readable media, comprising:
2 said computer readable media containing instructions for execution in a processor
3 for the practice of the method of claim 17 or claim 71 or claim 90.

1 96. Electromagnetic signals propagating on a computer network, comprising:
2 said electromagnetic signals carrying instructions for execution on a processor for
3 the practice of the method of claim 17 or claim 71 or claim 90.